PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 7 : C12Q 1/48

A1

(11) International Publication Number: WO 00/65087

(43) International Publication Date: 2 November 2000 (02.11.00)

(21) International Application Number: PCT/SE00/00772

(22) International Filing Date: 19 April 2000 (19.04.00)

(30) Priority Data:
PCT/IN99/00013 22 April 1999 (22.04.99) IN

(71) Applicant (*for all designated States except US*): ASTRAZENECA AB [SE/SE]; S-151 85 Södertälje (SE).

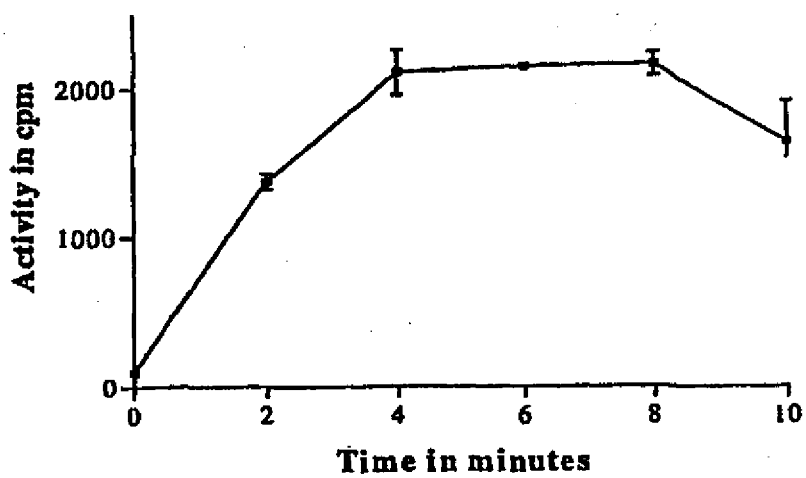
(72) Inventors; and
(75) Inventors/Applicants (*for US only*): DAS, Kaveri [IN/IN]; AstraZeneca R & D Bangalore, 277 T. Chowdaiah Road, Bangalore 560 003, Malleswaram (IN). RAMACHANDRAN, Janakiraman [US/IN]; AstraZeneca R & D Bangalore, 277 T. Chowdaiah Road, Bangalore 560 003, Malleswaram (IN).

(74) Agent: ASTRAZENECA AB; Global Intellectual Property, Patents, S-151 85 Södertälje (SE).

(81) Designated States: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published
With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: ASSAY FOR DETECTING PHOSPHO-N-ACETYLMURAMYL-PENTAPEPTIDE TRANSLOCASE ACTIVITY



(57) Abstract

The invention provides an assay for detecting phospho-*N*-acetylmuramyl-pentapeptide translocase enzyme activity, which comprises the steps of: (1) incubating a reaction mixture comprising, in aqueous medium, N-succinimidyl [2,3-^{3}H]propionate substituted UDP-MurNAc-pentapeptide, N-succinimidyl propionate substituted UDP-MurNAc-pentapeptide (non-radioactive), a source of divalent metal ions, a source of undecaprenyl phosphate, a source of translocase enzyme and a detergent, under conditions suitable for enzyme activity to occur; (2) acidification of the reaction mixture with a suitable buffer comprising a quaternary ammonium salt at pH ~4.2 to stop the enzyme reaction of step (1); and (3) extraction of any undecaprenol-pyrophosphate-[2,3-^{3}H]propionate-N-acetylmuramyl-pentapeptide product formed and measuring radioactivity using a scintillation counter; and also a kit for use therein.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece			TR	Turkey
BG	Bulgaria	HU	Hungary	ML	Mali	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MN	Mongolia	UA	Ukraine
BR	Brazil	IL	Israel	MR	Mauritania	UG	Uganda
BY	Belarus	IS	Iceland	MW	Malawi	US	United States of America
CA	Canada	IT	Italy	MX	Mexico	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NE	Niger	VN	Viet Nam
CG	Congo	KE	Kenya	NL	Netherlands	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NO	Norway	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	NZ	New Zealand		
CM	Cameroon			PL	Poland		
CN	China	KR	Republic of Korea	PT	Portugal		
CU	Cuba	KZ	Kazakstan	RO	Romania		
CZ	Czech Republic	LC	Saint Lucia	RU	Russian Federation		
DE	Germany	LI	Liechtenstein	SD	Sudan		
DK	Denmark	LK	Sri Lanka	SE	Sweden		
EE	Estonia	LR	Liberia	SG	Singapore		

Assay for detecting phospho-N-acetylmuramyl-pentapeptide translocase activity

The present invention relates to a new assay for the detection of phospho-*N*-acetylmuramyl-pentapeptide translocase enzyme activity (hereinafter referred to as "translocase enzyme").

Peptidoglycan is a major component of the bacterial cell wall that gives the wall its shape and strength. It is unique to bacteria and found in all bacteria, both gram-positive and gram-negative. Peptidoglycan is a polymer of glycan strands which are cross-linked through short peptide bridges. It consists of alternating β1-4 linked residues of *N*-acetyl glucosamine (Glc*N*Ac) and *N*-acetyl muramic acid (Mur*N*Ac). A pentapeptide chain is attached to Mur*N*Ac (Mur*N*Ac-pentapeptide) and the peptidoglycan polymers are crosslinked through these peptide chains.

Biosynthesis of peptidoglycan can be divided into three stages: firstly, synthesis of the precursors in the cytoplasm, secondly, transfer of the precursors to a lipid carrier molecule and, thirdly, insertion of the precursors into the cell wall and coupling to existing peptidoglycan.

Enzymes responsible for the biosynthesis of the peptidoglycan component of the bacterial cell wall are novel targets for the design of new antibiotics. Owing to the worldwide emergence of bacterial strains resistant to current antibiotics, it has become necessary to develop new antimicrobial agents. The translocase enzyme catalyses the first step in the membrane cycle of peptidoglycan biosynthesis, namely the transfer of phospho-*N*-acetylmuramyl-L-Ala-γ-D-Glu-*m*-diaminopimellic acid-D-Ala-D-Ala from Uridine 5'-diphosphate phospho-*N*-acetylmuramyl-L-Ala-γ-D-Glu-*m*-diaminopimellic acid-D-Ala-D-Ala (hereinafter referred to as "UDP-Mur*N*Ac- pentapeptide" or "UDP-MPP") to a membrane-bound lipid carrier, undecaprenyl phosphate. The translocase enzyme is encoded by the *mraY* gene in *Escherichia coli.*

The translocase enzyme is essential for bacterial viability (see D. Mengin-Lecreulx, L. Texier, M. Rousseaue and J. Van Heijernoot, J. Bacteriol., (1991), **173**, 4625-4636).

No commercial antibiotics in current use are directed against the translocase enzyme. It therefore represents a target for novel antibacterial agents which has as yet been unexploited.

The translocase enzyme is usually assayed by radiolabelling the UDP-Mur*N*Ac-pentapeptide and monitoring the transfer of phospho-*N*-acetylmuramyl pentapeptide from the UDP-Mur*N*Ac- pentapeptide to undecaprenyl phosphate, resulting in the formation of a lipid intermediate, Lipid I. The radiolabelling is usually done either by using the enzyme Ligase to label the D-Alanine-D-Alanine end or by the *in vivo* incorporation on the membrane. Both these methods produce low yields and thus are not cost effective in developing high-throughput-screening (HTS) assays.

The translocase enzyme activity may alternatively be assayed using a fluorescent substrate such as dansyl chloride as described by Brandish *et al.*, J. Biol. Chem., (1996), **271**, 7609-7614. However, certain compounds may quench the fluorescence, thus resulting in picking up false inhibitors of the enzyme reaction.

It would be desirable to develop an assay for the translocase enzyme that is suitable for high-throughout screening.

In accordance with the present invention, there is therefore provided an assay for detecting phospho-*N*-acetylmuramyl-pentapeptide translocase enzyme activity, which comprises the steps of:

(1) incubating a reaction mixture comprising, in aqueous medium, N-succinimidyl [2,3-^{3}H] propionate substituted UDP-Mur*N*Ac-pentapeptide, N-succinimidyl propionate substituted UDP-Mur*N*Ac-pentapeptide (non-radioactive), a source of divalent metal ions,

a source of undecaprenyl phosphate, a source of translocase enzyme and a detergent, under conditions suitable for enzyme activity to occur;

(2) acidification of the reaction mixture with a suitable buffer comprising a quaternary ammonium salt at pH ~ 4.2 to stop the enzyme reaction of step (1); and

(3) extraction of any undecaprenol-pyrophosphate-[2,3-^{3}H]propionate-N-acetylmuramylpentapeptide product formed and measuring radioactivity using a scintillation counter.

In step (1), the UDP-MPP used may be any of those normally present in naturally occurring peptidoglycans. It is conveniently purified from bacteria or made enzymatically with precursors from bacteria, for example by methods similar to that described by Blaauwen *et al.*; J. Bacteriol. (1990), **172**, 63-70. Alternatively, it may be isolated from cells of *B.subtilits* W23 by the methodology described by Lugtenberg *et al.*; J. Bacteriol. (1972), **109**, 326-335. The preferred UDP-MPP to use is UDP-Mur*N*Ac-L-Alanine-γ-D-glutamic acid-m-diaminopimellic acid-D-alanine-D-alanine from *Bacillus cereus*.

The UDP-MPP thus obtained is reacted with N-succinimidyl [2,3-^{3}H]propionate (commercially available from Amersham Ltd.) to obtain N-succinimidyl [2,3-^{3}H]propionate substituted UDP-Mur*N*Ac-pentapeptide (hereinafter referred to as "^{3}H-propionated UDP-MPP").

The concentration of ^{3}H-propionated UDP-MPP used in the assay will typically be in the range from 2 to 50 μM, preferably from 2 to 40 μM and more preferably from 2 to 25 μM.

The concentration of the unlabelled, non-radioactive N-succinimidyl propionate substituted UDP-MPP (hereinafter referred to as "propionated non-radioactive UDP-MPP") also used in the reaction may be in the range from 5 to 70μM, preferably from 5 to 50 μM and especially from 8 to 30 μM.

Divalent metal ions used in the reaction are preferably magnesium ions. A suitable source of magnesium ions is magnesium chloride. The concentration of divalent metal ions used may be in the range from 20mM to 100mM, preferably from 20mM to 80mM, more preferably from 20mM to 50mM, e.g. 25mM.

In addition, potassium chloride at a concentration in the range from 50mM to 100mM may be added to the reaction mixture.

The membranes of *Escherichia coli* bacteria may conveniently be used and indeed are preferred as a source of undecaprenyl phosphate and translocase enzyme. The quantity of membranes used will typically be in the range from 5 to 200µg, preferably 50µg, per 50µl of the reaction mixture. The membranes may be prepared by methods known in the art.

The aqueous medium used in step (1) is preferably a buffer solution, e.g. of Tris [hydroxymethyl] aminomethane hydrochloride ("Tris-HCl"), having a pH of about 7.5. Tris-HCl is commercially available from the Sigma Aldrich Co. Ltd.

The reaction mixture may additionally contain 0.01 unit of alkaline phosphatase.

The detergent used may, for example, be Triton X-100 in a concentration of 0.1% w/v. The detergent may be effective in solubilising the bacterial membranes if these are used.

If the assay is intended to be used as a screen for identifying anti-bacterial compounds that are antagonists of the translocase enzyme, the reaction mixture in step (1) may further comprise one or more test compounds in varying concentrations. Since translocase is the enzyme required in the first step of peptidoglycan synthesis, it represents a suitable target for the development anti-bacterial drugs.

The reaction mixture of step (1) is maintained at a temperature in the range from 20°C to 37°C, preferably 25°C, for a short period of time, e.g. up to 10 minutes, specifically 6-8 minutes.

The enzyme reaction is stopped by the addition of, for example, 6M pyridinium acetate and n-butanol (pH ~ 4.2) in a 2:1 mixture. This constitutes step (2).

In step (3), the product is extracted using, for example, n-butanol. It is then quantified in a scintillation counter.

The present invention will be further illustrated with reference to the following Example.

Example 1

Eppendorf tubes were individually filled with a total of 40 µl of the reaction mixture each, initially. The reaction mixture consisted of an aqueous buffer solution of 100 mM Tris-HCl (Tris[hydroxymethyl]aminomethane hydrochloride), 25mM magnesium chloride, 50mM of potassium chloride, 0.1%w/v Triton X-100, 8µ M of propionated non-radioactive UDP-MPP, 2 µM of ^{3}H-propionated UDP-MPP at room temperature, 10 µl of the enzyme at a concentration of 5 µg per ml and 17.5 µl of water. To this a solution of a test compound (e.g. Tunicamycin) of varying concentration is added. Tunicamycin is a known antagonist of the translocase enzyme. The reaction commences with the addition of the enzyme.

The *Escherichia coli* membranes, which serve as a source of the enzyme, were prepared in the following manner.

The membranes are prepared from spheroplast pellets which are commercially available. Each pellet contains a certain amount of *E.coli* Hfr H. The pellet is thawed overnight at 4°C. The pellet is weighed and the figure is multiplied by 7.5. This gives the volume of the buffer solution to be added to it. The buffer solution used is 20 µM Tris-HCl of pH

8.0, containing 20% sucrose. The mixture is stirred gently for 10 minutes using a magnetic stirrer in cold. To this is added, a solution of egg white lysozyme, till the concentration to get a final concentration of 0.2 mg per ml. It is stirred on ice for another 10 minutes. To this, EthyleneDiamineTetraacetic Acid (EDTA), commercially available from Sigma Aldrich Co. Ltd., of concentration 0.2 M in 20 mM Tris-HCl of pH 8.0, is added slowly over a period of one hour until a final concentration of 0.02M is obtained. This addition is carried out in a cold room at a temperature of 4-8°C. The mixture is then centrifuged at 12,000g for 20 minutes. The pellet is again resuspended in the same volume of 50 mM Tris-HCl buffer solution of pH 7.5 as calculated in the previous paragraph, containing, 20μg/ml DNAse, 20μg/ml RNAse, 1mM magnesium chloride and 1mM β-mercapto ethanol. This is stirred at room temperature for one hour until the sample becomes homogeneous. The membrane fraction is recovered by spinning in an ultra-centrifuge at 1,00,000g for an hour.

The ^3H-propionated UDP-MPP used as the substrate is prepared in the following manner.

A fixed volume of 4 O.D. at a wavelength of 262 nm i.e. approximately 450-500 μg unlabeled UDP-MPP is taken in an empty eppendorf tube. In another eppendorf tube, 0.5mCi of tritiated N-succinimidyl propionate (N-succinimidyl [2,3-^3H]propionate) is taken and to this, about 180μl of 1%$NaHCO_3$ is added. The second tube is mixed well and transferred to the first tube. The second tube is rinsed well, with 180μl of 1%$NaHCO_3$ and again transferred to the first tube. The tube, containing the mixture, is left overnight on a shaker at room temperature to facilitate labelling. In a similar manner, propionated non-radioactive UDP-MPP is prepared, using N-succinimidyl propionate instead of the radioactive compound.

It is purified as follows,

(1) A glass column is packed with 1ml of sephadex A-25, commercially available.

(2) The column is washed with a 10 bed volume of water.

(3) It is then equilibrated with a 10 bed volume of 1%$NaHCO_3$.

(4) The reaction mixture is loaded onto the column and the flow through is collected.

(5) The flow through is passed through the column twice, to facilitate binding.

(6) The column is then washed with 0.5 ml of 1% $NaHCO_3$.

(7) The wash and flow through is collected in the same tube and labelled.

(8) The column is washed with 6ml of 1%$NaHCO_3$, twice.

(9) The two washings are collected in the same tube and labelled.

(10) The column is eluted with 1ml of 1%$NaHCO_3$, containing 0.4M lithium chloride.

(11) The fractions are collected and labelled.

(12) The fractions are counted, and the purest ones used in the reaction.

The eppendorf tube containing the reaction mixture is incubated at 37°C for about 4 to 60 minutes and thereafter, every two minutes, 50µl of a 2:1 mixture of pyridinium acetate and n-butanol is added to stop the reaction.

The product is extracted with saturated n-butanol and washed with 50µl of water. It is then counted, 25-50 µl at a time on a scintillation counter.

The reaction catalysed by the enzyme translocase is known to be reversible. To show the reversible reaction, the enzyme reaction was continued for 10 mintues to form the radioactive product, undecaprenol-pyrophosphate-[2,3-^{3}H]propionate-N-acetylmuramylpentapeptide, Lipid I. This is seperated from its organic phase. Once the radioactive product is formed one set of reactions is stopped using the 2:1 pyridinium acetate and n-butanol mixture as described before. In a parallel set of reactions, 1µM UMP is added. The reaction is then stopped after about 3-4 minutes. The lipid fraction can be extracted from both the sets of reactions. It is seen that radioactive count in the organic phase is reduced to basal levels with UMP. This indicates the reversal of Lipid I to the water soluble precursor.

This example goes to show that the present assay system is specific for only the translocase reaction, even when a particulate membrane was used as the enzyme source.

Figure 1 is a graph showing the counts per minute (cpm) versus time based on the readings taken from the 100% controls.

Figure 2 shows the rate of inhibition of translocase by Tunicamycin at 0.3 μg/ml concentration (indicated by ▲) compared with the control (indicated by ■). This confirms that Tunicamycin is an antagonist of the translocase enzyme.

CLAIMS

1. An assay for detecting phospho-*N*-acetylmuramyl-pentapeptide translocase enzyme activity, which comprises the steps of:

(1) incubating a reaction mixture comprising, in aqueous medium, N-succinimidyl [2,3-^{3}H] propionate substituted UDP-Mur*N*Ac-pentapeptide, N-succinimidyl propionate substituted UDP-Mur*N*Ac-pentapeptide (non-radioactive), a source of divalent metal ions, a source of undecaprenyl phosphate, a source of translocase enzyme and a detergent, under conditions suitable for enzyme activity to occur;
(2) acidification of the reaction mixture with a suitable buffer comprising a quaternary ammonium salt at pH ~ 4.2 to stop the enzyme reaction of step (1); and
(3) extraction of any undecaprenol-pyrophosphate-[2,3-^{3}H]propionate-N-acetylmuramylpentapeptide product formed and measuring radioactivity using a scintillation counter.

2. An assay according to claim 1, wherein the UDP-*N*-acetylmuramylpentapeptide which is substituted is UDP-Mur*N*Ac-L-Alanine-γ-D-glutamic acid-m-diaminopimellic acid-D-alanine-D-alanine.

3. An assay according to claim 1 or claim 2, wherein magnesium chloride is used as a source of divalent metal ions.

4. An assay according to any one of claims 1 to3, wherein bacterial cell membranes are used as a source of one or both of undecaprenyl phosphate and translocase enzyme.

5. An assay according to claim 4, wherein the bacterial cell membranes are from *Escherichia coli*.

6. An assay according to any one of claims 1 to 5, wherein the reaction mixture of step (1) further comprises a test compound.

7. An assay according to claim 6, wherein the test compound is an antagonist of the translocase enzyme.

8. An assay according to any one of claims 1 to 7, wherein a 2:1 mixture of pyridinium acetate and n-butanol is used to stop the reaction in step (2).

9. An assay according to any one of the claims 1 to 7, wherein the product in step (3) is extracted using n-butanol.

10. A kit for use in performing an assay according to any one of the preceding claims, which comprises,

(1) N-succinimidyl [2,3-^{3}H] propionate substituted UDP-Mur*N*Ac-pentapeptide,

(2) N-succinimidyl propionate substituted UDP-Mur*N*Ac-pentapeptide (non-radioactive),

(3) a source of divalent metal ions,

(4) a source of undecaprenyl phosphate,

(5) a source of phospho-*N*-acetylmuramyl-pentapeptide translocase enzyme, and

(6) a detergent.

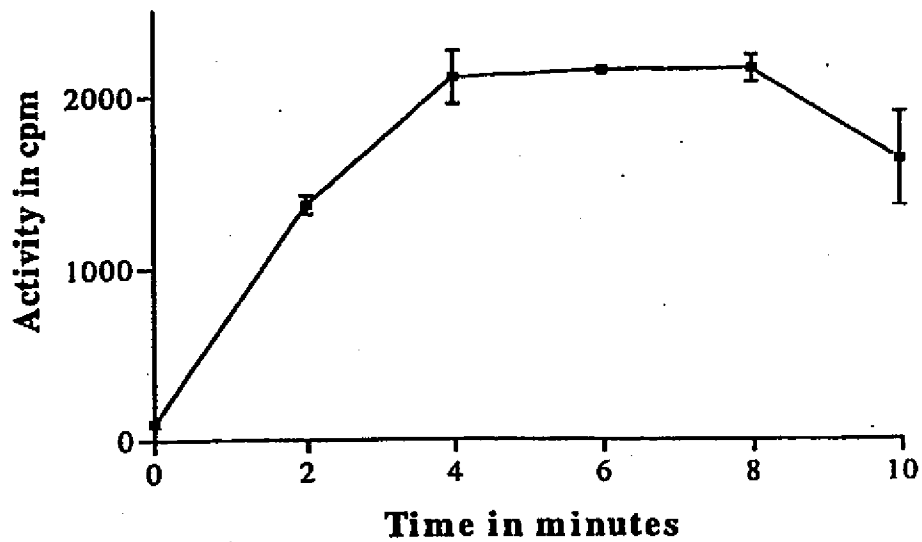

Activity in cpm
2000
1000
0
0
2
4
6
8
10
Time in minutes

Fig. 1

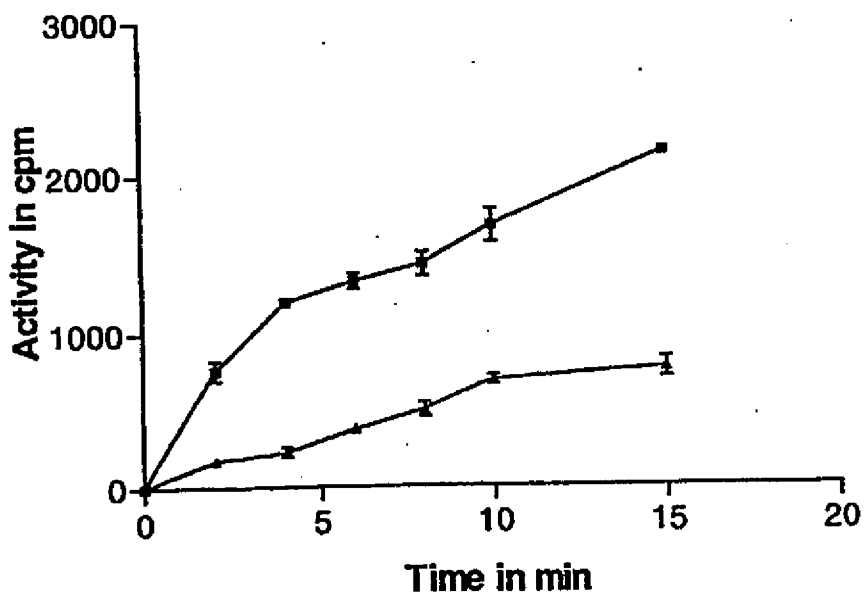

3000
Activity in cpm
2000
1000
0
0
5
10
15
20
Time in min

Fig. 2

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 00/00772

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: C12Q 1/48

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: C12Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,X	WO 0010587 A1 (INCARA PHARMACEUTICALS CORP.), 2 March 2000 (02.03.00), see page 4; and page 16, third paragraph --	1-10
A	EP 0897007 A2 (SMITHKLINE BEECHAM CORPORATION ET AL), 17 February 1999 (17.02.99), see page 15, lines 41-55 --	1-10
A	EP 0890644 A2 (SMITHKLINE BEECHAM CORPORATION), 13 January 1999 (13.01.99) --	1-10
A	WO 9615258 A1 (THE UPJOHN COMPANY), 23 May 1996 (23.05.96) --	1-10

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
21 August 2000	28 -08- 2000
Name and mailing address of the ISA Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Carolina Palmcrantz/gh Telephone No. +46 8 782 25 00

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	Drug discovery today, Volume 1, No 7, 1996, Neil D. Cook, "Scintillation proximity assay: a versatile high-throughput screening technology" page 287 - page 294 -- --------	1-10

INTERNATIONAL SEARCH REPORT

Information on patent family members

08/05/00

International application No.
PCT/SE 00/00772

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 0010587 A1	02/03/00	EP 0965992 A	22/12/99
		JP 2000013059 A	14/01/00
EP 0897007 A2	17/02/99	JP 11146794 A	02/06/99
EP 0890644 A2	13/01/99	JP 11137248 A	25/05/99
WO 9615258 A1	23/05/96	AT 191012 T	15/04/00
		AU 4278196 A	06/06/96
		DE 69515901 D	00/00/00
		EP 0792373 A,B	03/09/97
		SE 0792373 T3	
		JP 10508749 T	02/09/98
		US 5861318 A	19/01/99